



REE

RED ELECTRICA

Annual Report 1997



Operation of the transmission network



Performance of the transmission network

Losses in power transmission in the RED ELECTRICA network during 1997 were 1.04%, an identical figure to the previous year. Hydraulic generation was less than the preceding year but there was a greater increase compared to other years in gas-fuelled generation although it was not as close to the centres of consumption.

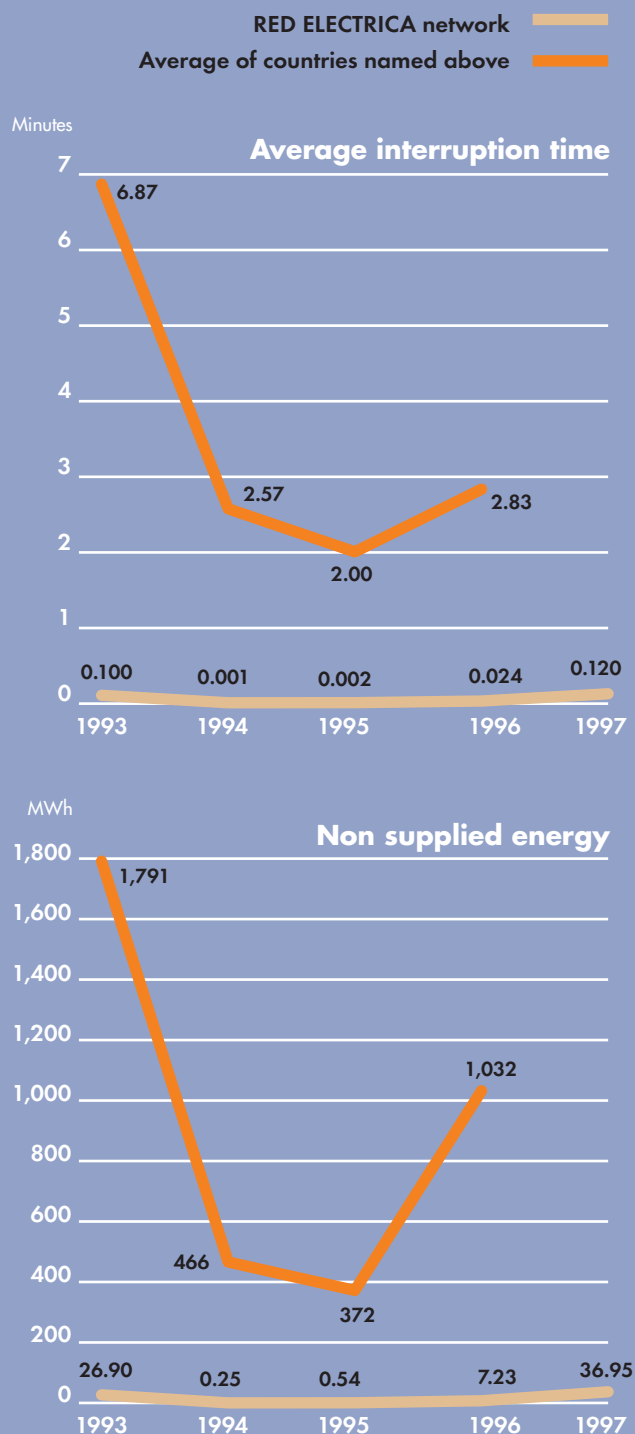
Voltages were maintained inside normal limits and only momentarily low values were recorded. The majority of 400 kV measurements were between 399 and 433 kV while those of 220 kV ranged between 224 and 243 kV. These figures are very similar to 1996.

The average load at the transformers fell compared to the previous year except in Aragon, Galicia and the Basque Country. The area with the heaviest load continued to be Madrid, which reached an average of 45% while the average in the other areas was not greater than 40%.

The average load on the 400 kV lines was greater than the previous year while the figures for the 220 kV lines were similar. There was a greater number of 400 kV lines which recorded maximum loads of 70% although this situation occurred during a much smaller number of hours than the previous year. The number of 220 kV lines with excess loads was also greater-although this occurred during much less time and without exceeding the maximum load recorded in 1996.

During 1997 the number of outages decreased both programmed and forced. In RED ELECTRICA lines, the total number of 400 kV outages increased. This was due to programmed outages-as the forced outages decreased.

Performance indices for RED ELECTRICA's network compared with the average figures for the transmission grids of France, Portugal, UK, Sweden and Spain



Unavailability rates	%
Preventive maintenance	1.10
Fortuitous	0.04
Causes other than maintenance	2.42
TOTAL	3.56

Service quality indicators

The movements of the indicators of quality of the transmission service were as follows:

Not supplied energy

The annual electric power not supplied due to disturbances in the RED ELECTRICA transmission network was 36.95 MWh.

Average interruption time

Since 1986 this indicator, which relates the power not supplied due to disturbances in RED ELECTRICA network to the average power in the system, has recorded figures of less than one minute. This reflects the high level of the quality of service provided. In 1997 the figure was 0.12 minutes.

Unavailability rate

The unavailability rate measures the average time which each line has been out of service due to outages for preventive maintenance, due to accidental unavailability caused by temporary or permanent failures and that due to other causes, unconnected with maintenance, such as the construction of new facilities or factors external to the network. The value and composition of this index, which reflects the quality and continuity of the service provided by the power system, is shown in Table 3.

In 1997 the overall availability was 96.44% and this means the overall unavailability due to maintenance (preventive and accidental) was slightly less than previous years.

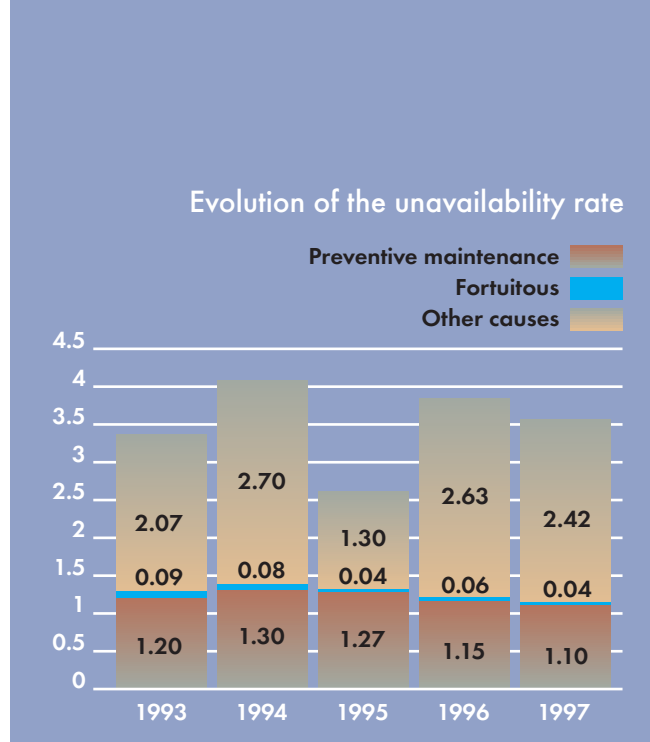


Table 4

Maintenance outages

	110 KV	220 KV	400 KV	TOTAL
Number	1	92	143	236
Average duration (hours)	16.5	110.19	84.89	94.47

Table 5

Forced outages

	110 KV	220 KV	400 KV	TOTAL
Number				
With automatic re-closing	0	151	274	425
Duration under 5 minutes.	1	76	52	129
Duration from 5 min. to 5 hr	4	64	111	179
Duration over 5 hours	1	5	22	28
TOTAL	6	296	459	761
Average unavailable time per circuit due to accidental causes (hours)	5.73	2.19	4.69	3.76
Average duration of interruptions over 5 minutes (hours)	3.41	2.51	5.06	4.17

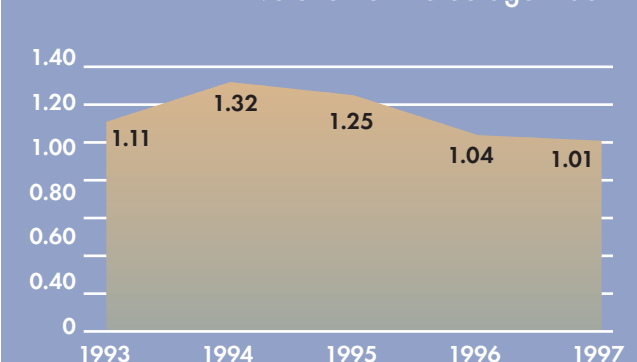
Table 6

Causes of forced outages

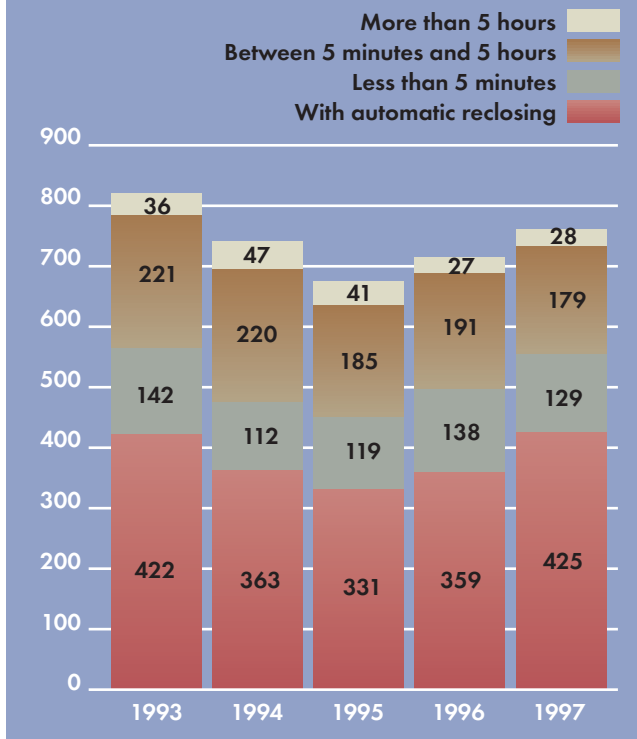
	%
Fire under the lines	5.1
Weather	49.5
Line material faults	1.5
Substation equipment faults	1.2
Protection device faults	1.6
Other causes	15.0
Unknown	26.1
TOTAL	100.0

Maintenance outages

The scheduling of maintenance work, based on criteria of maximum grouping, together with the growing use of predictive techniques and live-line working, resulted in a significant reduction in the number of outages per network circuit. The outage index in 1997 was 1.01 compared to 1.04 in 1996. Table 4 shows the number of outages and their average duration according to the voltage level.

Evolution of the outage index

Evolution of events involving protection mechanisms



Forced outages and disturbances

During 1997 there were 761 forced outages in the transmission lines which caused them to open suddenly. These were basically due to thunderstorms and fog in the summer and winter months.

Tables 5 shows the classification of these outages according to their duration and Table 6 shows the distribution of the causes which provoked them.

Equipment and system performance

Lines and substations

The rate of breakdowns in RED ELECTRICA's transmission lines causing temporary unavailability, was 0.027 breakdowns per 100 km of circuit in 1997, compared with 0.038 in 1996. The average unavailability due to accidental causes per circuit was also less, 3.76 hours against 4.27 hours in 1996.

In the case of substations, the average unavailability time per busbar connection with circuit breaker was 0.69 hours in 1997, compared to 0.79 in 1996, Table 7 shows the number of breakdowns for each type of equipment and its failure rate (the failures of a given type of equipment expressed as a percentage of the total for these items).

The performance index for the protection devices also improved to 95.7% compared to 94.2% in 1996. The devices were activated 2,480 times and 2,374 of these were correct.

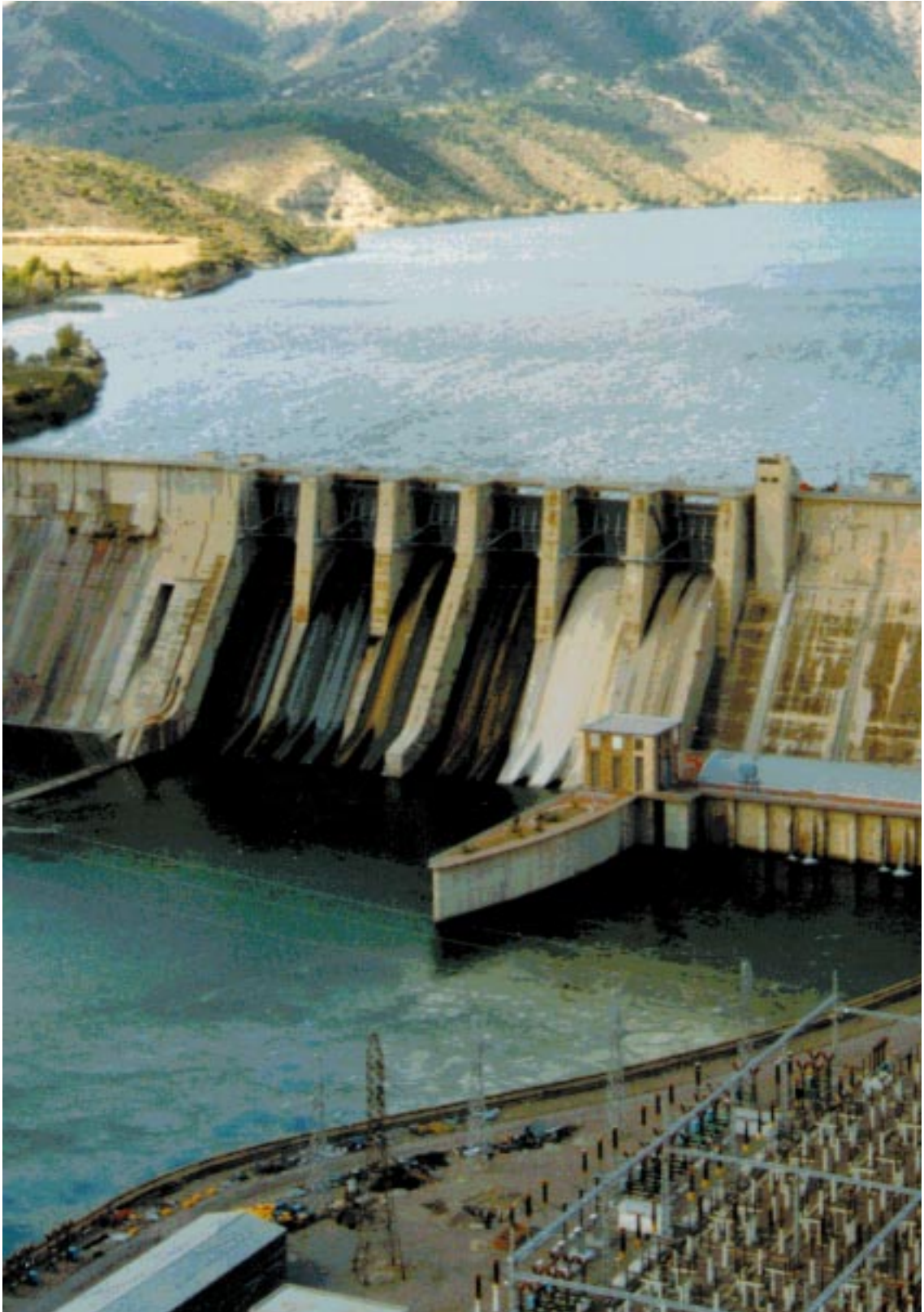
Remote control systems

During 1997 the operation of 31 digital control systems and 63 remote control stations was analysed and the results obtained show availability rates of 99.98% and 99.89%, respectively. These figures are practically identical to 1996.

Table 7

Equipment	No. of Faults	Failure rate
Reactance equipment ..	4	1.50
Power transformers	0	0.00
Circuit breakers	17	2.68
Isolators	37	2.19
Current transformers	5	0.30
Voltage transformers	14	0.83

Operation of the electric power system



The new regulatory framework

The Electricity Act, approved in November 1997, means an important step in the deregulation of the power sector. It creates a market for the electricity generation based on competition.

RED ELECTRICA played a notable role in the creation of the different operational instruments which made it possible to initiate the electricity market on January 1, 1998. This was a process which commenced in December 1996 with the signing of the Electricity Protocol and it has been carried further with the approval of the new law and the complementary regulations.

The market operator

The law creates a new figure, the market operator, in the form of a commercial company which is to manage the system of buying-selling offers of power between generators, distributors, brokers and qualified consumers. This company, Compañía Operadora del Mercado Español de Electricidad, S.A., incorporated in December 1997 with a share capital of 300 million pesetas fully subscribed by RED ELECTRICA, assumed the commercial management of the system from January 1st, 1998.

The incorporation of this company was preceded by intense activity at RED ELECTRICA in which the utility companies, CNSE, the Ministry of Industry and Energy and consultants, participated. During the last quarter of 1997, RED ELECTRICA provided this company with computer systems and the resources necessary to guarantee operational feasibility and the transparency of the transactions which are carried out in the electricity generation market.

The system operator

The law confirms RED ELECTRICA as the company in charge of electricity transmission and entrusts it with the responsibility of handling the technical management of the power system, which is the function associated with the system operator, and also with the management of the transmission grid.

RED ELECTRICA developed the procedures and computer systems needed to ensure that the operation of the system, apart from guaranteeing the reliability and continuity of the electricity supply, would reflect the criteria for the successful operation of the electricity market.

In particular, standards and computer systems were implemented to manage the technical restrictions of the transmission grid and of the system (which have to respond to market criteria) and to manage the market for complementary services (which will also be governed by

a system of offers) as well as the computer, communication and co-ordination systems between the Operator Company and the market brokers.

Operation data

The representative data of the operation of the electricity system during 1997 were as follows:

Demand

Annual demand for electric power reached a cumulative total of 162,180 GWh at the power plant busbars. This was an increase of 3.80% over the previous year. If the effect of the leap year is taken into account the increase is 4.12%. After correction for labour effects and temperature, the increase in demand is calculated at 5.40%.

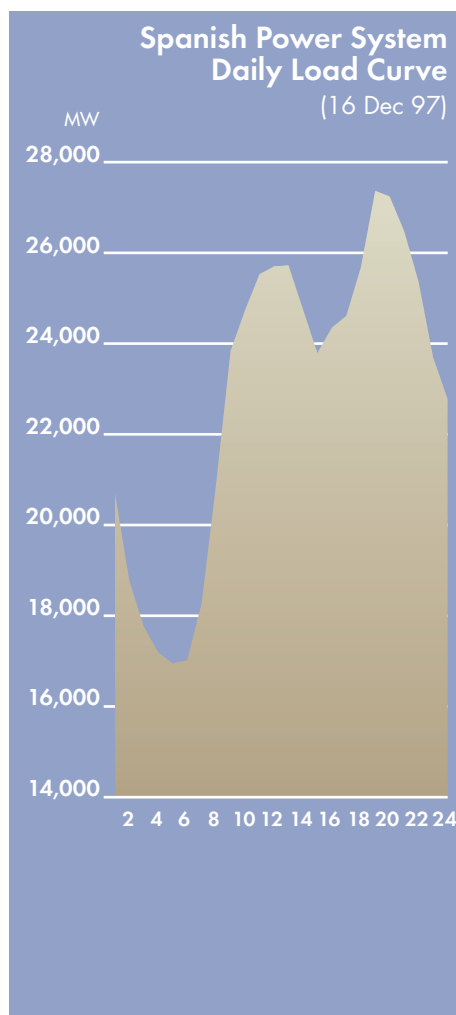


Table 8		
Breakdown of generation in 1997		
POWER	GWh	% of total
Hydroelectric	33,168	21
Nuclear	55,298	35
Coal	62,098	40
Oil+ Gas	6,843	4
TOTAL	157,407	100

The values for monthly, daily and hourly demand reached historic maximums. The monthly maximum occurred in December with 14,837 GWh; the daily maximum was recorded on December 16th at 559.4 GWh and the maximum hourly average power demand reached 27,369 MW at 19.00 hours on the same day.

Generation

The total power generated by the mainland system increased by 5.95% compared to the previous year. The distribution of generation was affected by the increase in production using gas and Spanish coal, to reduce coal stocks and cover the minimum gas quota, and by the high hydroelectric producibility index of 1.20. Hydraulic reserves

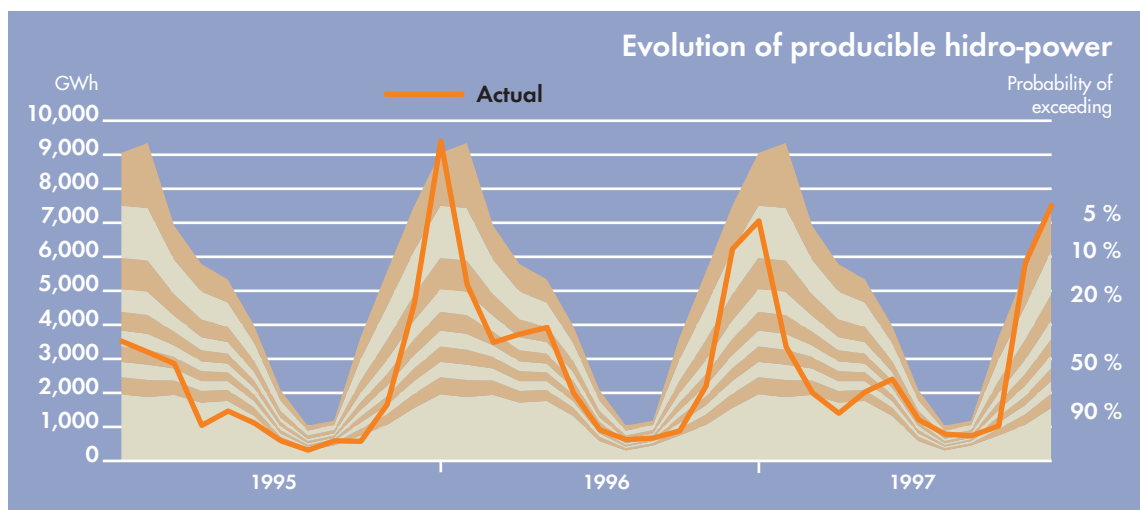
reached historic maximums at the end of the year with 75% of storage capacity at the dams used by hydroelectric stations, 20% more than the previous year.

Hydroelectric power generation was 21% of total, 4% less than the previous year. Nuclear power generation was also down by 3% to 35% of total. Generation from coal was 40%, which was an increase of 5% on the previous year. Gas generation represented 4% of total generation, 3% higher than last year. Lastly, generation from oil-fired plants which was 1% in the preceding year, came to practically zero.

Self-generation supplied 15,958 GWh to the system, up 17% on the previous year. There was a sharp drop in the rate of growth compared to 1996 when self-generation grew 42% over 1995.

The coal-fired stations produced 62,098 GWh with an increase of 19% over the preceding year. This increase was due to the high use of Spanish coal which recorded a historic maximum of 59,266 GWh, 27% up on 1996. The availability of generating plants reached 93% including scheduled outages and the connected equipment usage factor was 90%.

Hydroelectric power generated from new natural flows and reserves was 32,035 GWh. Power generated from closed cycle pumped storage reached 1,133 GWh and total hydroelectric generation was therefore 33,168 GWh. This figure is 10% higher than the output which would occur in a year of average hydraulic activity.



Nuclear generation was 55,298 GWh. The overall availability of nuclear power plants, including the reloading of fuel and programmed inspections, reached 87%, 1% more than the previous year, and the utilisation factor of the connected equipment was 95%, 2% less than in 1996.

Oil-fired and gas-fired power stations supplied 4% of total generation at 6,843 GWh. This was fundamentally due to gas-fired stations which produced a historic maximum of 6,597 GWh. Total availability was 83% and the utilisation factor of the connected equipment came to 64%.

Regulation

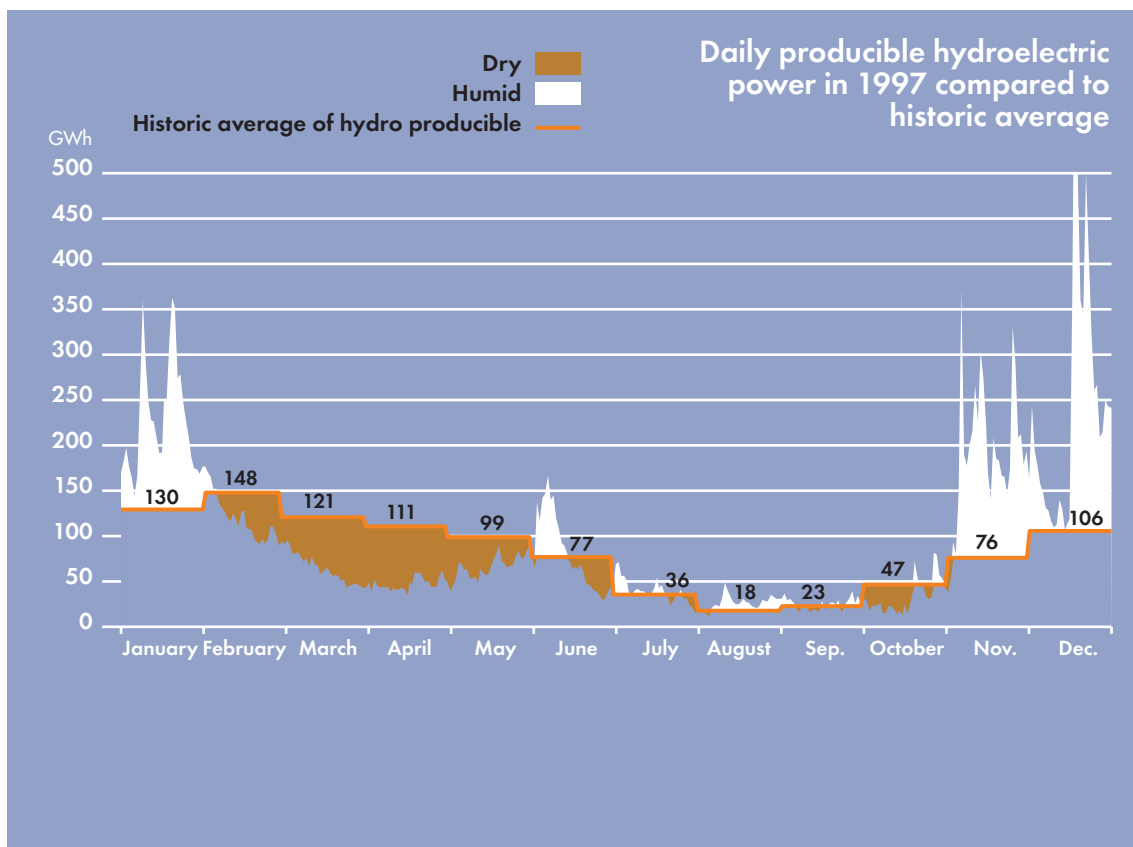
A smaller number of deviations was recorded than in 1996 related to the scheduling of the interconnection with France. There were 40 deviations of more than 500 MW, compared to 108 in the preceding year, and their duration was shorter although the maximum recorded values were greater than 1996. Only in the last quarter there were more deviations than in the same period in the previous year, due to greater hydraulic activity, mainly in december. Most of the deviations were recorded during the hours around midnight and in the early hours of the morning when the load comes on. Those related to power exports predominated (58%).

Variable cost of generation

The variable cost of net generation (fuel plus variable operating and maintenance costs) in the power system in 1997 came to 387,790 million pesetas. This figure is 21% higher than that of the preceding year (at constant fuel prices) compared to a net increase in generation of 6%. The more expensive generation was attributable to the lower hydroelectric generation during the year.

The export balance of the international power exchanges reduced the cost of power available in the market by 11,132 million pesetas to 377,327 million pesetas after taking into account the 669 million pesetas from pumping consumption.

The average variable cost of net generation during the year was 0.33 pesetas per kWh greater than the previous year (at constant fuel prices) and came to 2.58 pesetas per kWh.



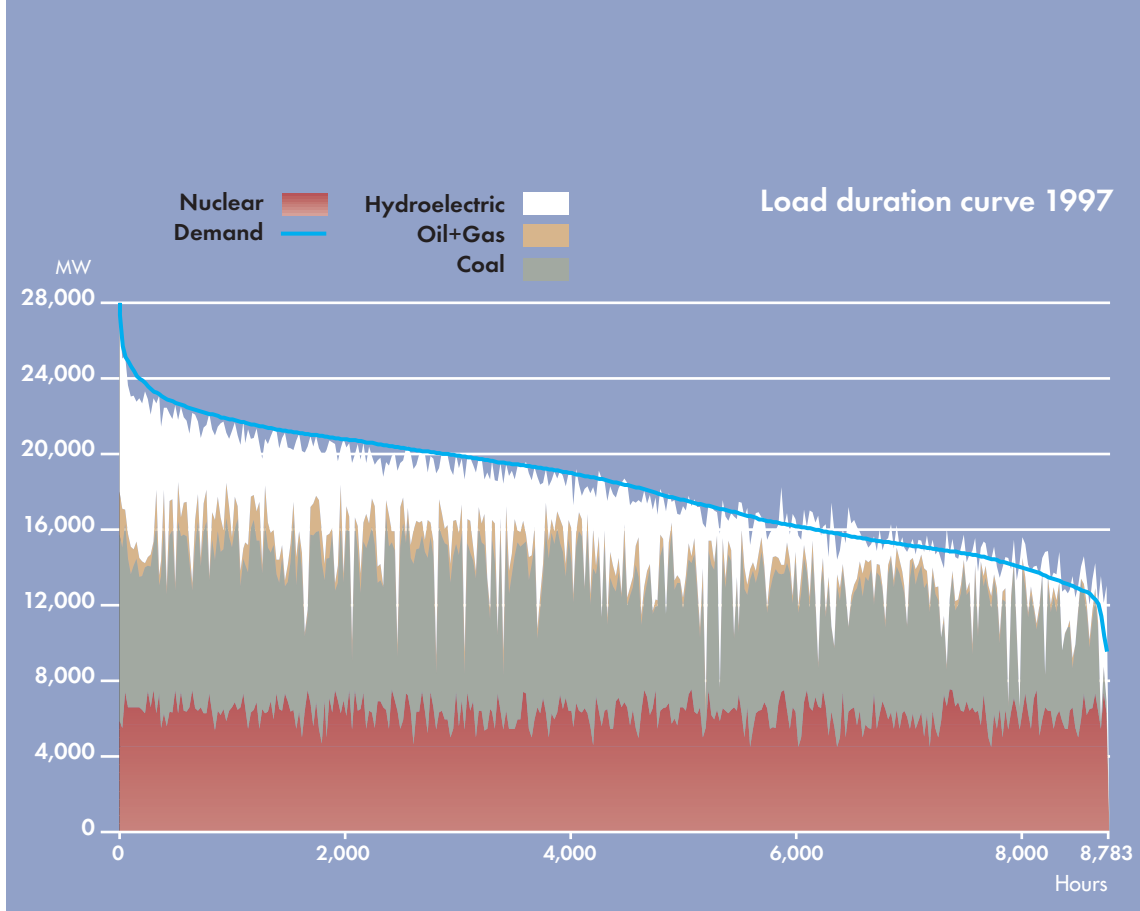


Table 9

Programmed international exchanges (GWh)

COUNTRY	Imports	Exports	Net Exporter
France	1,404	1,258	-146
Portugal	13	2,910	2,897
Andorra	1	125	124
Switzerland	0	64	64
Belgium	0	3	3
Morocco	2	133	131
TOTAL	1,420	4,493	3,073

International power exchanges

The total amount of power passing through the international interconnections in 1997 (total of inflows and outflows) was 12,266 GWh, 1% less than the previous year.

With regard to scheduled power transfers related to international agreements, the electric power exported in 1997 surpassed historic maximums reaching 4,493 GWh. That, together with the 61% drop in imports compared to the preceding year, resulted in a net export balance of international exchanges of 3,073 GWh, which was also a historic record.

Table 10

Power flow-through international interconnections (GWh)

COUNTRY	In-flow	Outflow	Total Volume
France	2,114	2,054	4,168
Portugal	2,481	5,378	7,858
Andorra	0	105	105
Morocco	2	133	135
TOTAL	4,597	7,670	12,266

The total of these exchanges resulted in a profit for the electricity system estimated at 3,369 million pesetas.

During the month of October and in the first few days of November full-scale trials were carried out on the power interconnection between Morocco and Spain during which 133 GWh were exported and 2 GWh imported.

New tools for the system operation

The operation of the electricity system was managed from the Electricity Control Centre (CECOEL) with support from the Regional Operation Centres (CEORE) of RED ELECTRICA and the Control Centres of the utility companies with the object of ensuring the continuity and quality of the power supply at all times and with a minimum cost of generated power in accordance with guidelines of the energy policy.

In May the new Control Centre of RED ELECTRICA was opened and the new Control System was commissioned. The old system was kept in operation and run in parallel until October to ensure a totally reliable transition between the two systems.

The new Control System needed an intensive training plan for the operators aimed at getting the most out of the features of the new tool. The Operator Training Simulator (OTS) of the new system has also been used since January in the training program for the CECOEL and CEORE operators, which covers the implementation of plans for power restore procedures. So far there has been a total of 120 sessions with an average of 30 hours per operator.

In order to carry out the functions assigned to RED ELECTRICA, as operator of the electricity system in the new regulatory framework, it was necessary to redefine the scheduling and real time operation procedures and to develop a provisional computer system for scheduling generation, for the management of complementary services for secondary and tertiary regulation and for the compensation of deviations between programmed generation and demand. This system, known as the

Operator Management System, was developed by RED ELECTRICA during the months of November and December in accordance with the specifications agreed between the market operator and the utility companies for the reception and processing of offers and the exchange of information.

New support tools were added to the Control System to help the operators. These included:

- The Expert System for the Planning of Outages which has greatly enhanced functionality compared to its predecessor.
- The Expert System for Network Status Prediction, also installed in the CEORE.

The activities aimed at guaranteeing the safety of the electricity system included the following:

- The revision of current procedures for restoring supply in the Galicia-Leon and the East-outh regions, and updating of those for the Duero and the Asturias-Cantabria regions.
- Three simulations were carried out for the restoration of supply in the East, South and Centre areas using the OTS for the reconstruction of the network. These simulations were co-ordinated by the CECOEL and the CEORE and the utility companies took part. Moreover, full scale tests were carried out on the independent start-up of generating equipment, powering up the system, etc., to ensure that this equipment will be available in the event of a real restore operation.

Quality assurance items

During 1997 the System Operation Quality Plan (according to the ISO 9002 standard) was commenced. The Quality and Quality Procedure Manuals were produced and the Operation Manual was adapted to the quality standards. The system has been formally commissioned and successfully passed an internal audit. This will make it possible to apply for the quality certificate once procedures are adapted to the new regulatory framework.